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Research Article

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Frequency Analysis as a Tool for Optimising Processes in Living Organisms and in Agricultural Businesses

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ABSTRACT
The optimised functioning of processes in plants, animals and humans means efficient utilisation of food and feed and a reduction in disease. Both factors are, or become, cost-intensive when causes must be sought in order to restore optimal utilisation or reduce or eliminate disease. Similarly, the administration of medication in the event of illness or as a prophylactic measure means bypassing the biological cycle, which may solve one problem but potentially creates another. The aim is to use frequency analyses to quickly and efficiently identify process errors in living organisms so that they can then be corrected. Diseases in organisms are mainly caused by supply deficits and detoxification problems, with both approaches being directly related. These main causes are always accompanied by harmful agents that exploit the newly created environment for their own benefit. The method used to test this theoretical approach is initially qualitative empirical research. Once the hypothesis has been confirmed, the results are extended to quantitative empirical research. Basically, field research proves that pathogens and pollutants can be detected in living organisms without great effort, which is confirmed by intersubjective agreement models. The application of a mixed methodology is based on the generalisation model.

Keywords: Diseases in Livestock, Plant Diseases, Pests and Pollutants, Optimisation of Processes in Living Organisms, Environmental Protection, Animal Protection, Animal Welfare, Reduction of Chemicals, Optimisation of Harvests, Improvement of Product Quality

JEL Classification: Q1, Q3, Q5, Q52, Q55, Q57

Introduction

The health of plants and animals is the foundation for sustainable agriculture and economic success. Agricultural businesses around the world are increasingly facing challenges caused by pests, pollutants and climate change. These factors not only affect productivity, but also the quality of agricultural products and harm the health of plants, animals and humans. Rapid growth in various sectors, such as agriculture, is placing an increasing strain on nature and the environment. Environmental toxins such as heavy metals and pesticides are not exclusively anthropogenic in origin, but come from various sources. They affect abiotic elements such as soil and water, as well as biotic elements such as plants and animals, and ultimately humans too. For example, pesticides can alter the physical, chemical and biological properties of the soil. This change in conversion processes and the hidden hunger of plants is addressed in the FAO report published in 2020, which explicitly points out that synthetic environmental toxins in agriculture severely limit soil diversity (and thus also the diversity of soil organisms). This in turn means fewer biochemicals from the soil biome due to the impoverishment of microfauna. Process-relevant micronutrients and trace elements cannot be absorbed and are therefore not available later on. This can lead to a cycle of deficiency, which in turn leads to deficits and diseases in plants, animals and humans, an issue addressed by WHITE and BROADLEY in their 2009 analysis. Their work focuses on specific micronutrients that are

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most commonly lacking or absent in, causing metabolic disorders in animals and humans. In addition, they identified antinutrients that accumulate as a result of these disrupted processes and can thereby impair the absorption of other nutrients. It has been proven that nutrients are not only directly important for the growth and metabolic processes of plants and animals, but also influence their defence mechanisms against pathogens. Malnutrition weakens these defence mechanisms and makes the organism more susceptible to infections. Children in particular are much more likely to fall ill or die from infections if they do not receive all the nutrients they need. In plants, zinc deficiency ultimately leads to serious health problems in humans, such as growth disorders, a weakened immune system and an increased risk of cancer and infections. In pigs, for example, nutrient deficiencies and the associated risk that pathogenic agents such as E. coli, Mycoplasma hypopneumonia and Salmonella overcome the defence barrier ("colonisation") or simply cannot be fought off at all due to the weakened immune system. In this context, new methods for the early detection and targeted control of pests and pollutants in living organisms are of great interest. One promising approach is frequency analysis. This approach enables the discovery of specific frequency patterns associated with biological processes in plants and animals. These frequencies can be analysed to detect infections or stress in the host at an early stage, even before signs of infection or stress appear. This opens up a range of potential applications for prevention and personalised health monitoring. The research topic is the investigation of frequency analysis as a diagnostic tool for the detection and elimination of pests and pollutants in agricultural technological processes. The diagnostic accuracy and the gentle and rapid inactivation of pests and pollutants by frequency analysis are being investigated. From an economic perspective, the extent to which frequency analysis represents a competitive, effective and sustainable alternative to conventional diagnostic and treatment methods is also being investigated [1,2]. The main objective of the research is to investigate the mechanism and performance of frequency analysis as a technological tool, including its detection capabilities and ability to neutralise environmental pollution, taking into account its practical application and economic benefits.

Theoretical Background

Frequency analysis diagnostics is often met with scepticism and rejection in conventional circles and in specialist literature. The argument put forward is that it is unscientific. The reason given is the lack of randomised, placebo-controlled double-blind studies to obtain comparable results, which form the basis of conventional systems. In living organisms, there are no identical and therefore no comparable system states. These are individual-specific symptom structures, with individual pathogens and pollutants, which are always composed differently [3].

The theoretical and practical approach of frequency technology states that every vibrating molecule not only emits a characteristic series of electromagnetic frequencies, but similar molecules in the environment also absorb the same frequencies. The resulting absorption spectrum can be measured. This approach is based on phenomena and theoretical consequences that can be considered established in physics with regard to the phenomenon of the distinguishability of similar particles, which poses a philosophical challenge due to the existing measurement problem, the connection between the micro and macro worlds, defined as a fundamental problem in any type of measurement. In this context, he goes on to explain that in order to obtain a mean value – which is used to determine statistical errors – it is necessary to repeat the measurement frequently under the same parameters. The determination of the frequency spectrum of the harmful agents and pollutants found is based on probabilities and becomes more specific the more often the measurement process is repeated under the same conditions.

The theoretical and practical approach we are pursuing is described as follows: A stainless-steel vibrating plate is positioned in a Faraday cage, on which a smear container moistened with bodily secretions is placed. A weak electrical impulse applied to a suitable carrier material (in this case, a conductive plate) can be converted into mechanical vibrations through electromechanical coupling. These vibrations are transmitted to all substances on the surface, including microorganisms or chemical compounds on a swab. The resulting vibration behaviour can lead to resonance-induced amplification or modulation of the movement at the microscopic level. Such physical effects form the basis of numerous biosensor methods, e.g. in the use of quartz crystal microbalance (QCM), in which frequency or impedance changes are used to detect biomolecules. In addition, targeted frequency excitation opens up possibilities for investigating interactions between electromagnetic fields and biological material. Frequency analysis of the generated field provides information about the physiological properties of microorganisms and pollutants as well as their classification. The following physical laws are based on this principle:

- Mechanical vibration and resonance: All objects have a natural frequency at which they vibrate most strongly, including the vibrating plate. This principle is also used when
- vibrations are generated by an external impulse. A system can be set into vibration by external impacts. If the frequency of the external impulse corresponds to the natural frequency of the system (e.g. the vibrating gold plate or the microbes), strong vibrations can be emitted or extinguished due to destructive processes.
- Electromagnetic interactions: Electromagnetic fields: The electrical impulse acting on the vibrating plate generates electromagnetic fields that induce the plate to vibrate. According to Maxwell's equations (which describe classical electrodynamics), an electromagnetic field can cause vibrations in a conductive material (e.g. stainless steel). For the sake of completeness, induction should also be mentioned: when the vibrating plate oscillates, it causes changes in the electromagnetic field that can be detected by sensors. This is based on electromagnetic induction: when a magnetic field moves in a conductive body, a voltage is induced that is detected by the system.
- Biological correlates of mechanical vibrations: These are biological molecular vibrations generated by biological molecules, especially proteins and other biological molecules. They are characterised by different vibration modes that can be excited by external forces. These vibrations can be disturbed by magnetic fields. Biophysics shows how mechanical vibrations work in organisms. Mechanical signals (i.e. vibrations) can also be converted into biological signals through mechanotransduction. These

biological systems are tuned to specific frequencies and can therefore experience voltage modulations that are picked up by the vibration.

- Spectral analysis and frequency representation are illustrated using Fourier analysis, in which a signal is expressed in terms of its frequency components. This method is a fundamental approach in signal processing and is used to capture the frequencies caused by the vibrations of microorganisms. Fourier analysis is one of the central techniques in mathematics and physics and is used in many areas, including signal processing, communication technology, acoustics, electrical engineering and others. It breaks down a complex, time-dependent signal into simpler, sinusoidal parts. These sine waves, which are determined by their frequency, provide detailed information about the composition of the signal by indicating the underlying frequency composition. The fundamentals of the theory and mathematical structure of Fourier analysis are provided by functional analysis and expressed in the (mathematical) evaluation of these functions in formal (orthonormal) series. For aperiodic signals (O.F.A), we used the Fourier transform. This is a generalisation of the Fourier series that can be applied to any non-periodic function. The spectrum F(ω) represents the frequency content of the signal and is obtained by calculating the Fourier transform of a function f (t). The following applies [5-9]:

$$F(\omega) = \int_{-\infty}^{\infty} f(t) e^{-iwt} dt$$

where (ω) = 2πf is the angular velocity and f is the signal frequency. The Fourier transform generates a complex value function that contains both the amplitude (magnitude) and the phase of the frequency components. This can be represented graphically as follows:

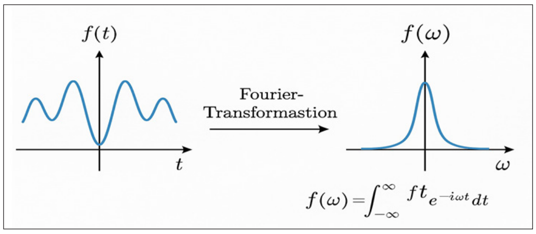

Figure 1: OSENUM. Fourier transform from formula [own representation] 2025

With the help of the inverse Fourier transform, we can reconstruct the original signal from its frequencies:

$$f(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} F(\omega) e^{iwt} d\omega$$

Here, F(ω) is the spectrum of the signal, and the equation states that the signal wave f(t) could be reconstructed by adding the frequency components together with the exponent.

Research Methodology

Explanation of the Experiment

All analyses performed on the animals comply with European Directive 2010/63/EU of 22 September 2010

Animals and Housing

The litters of 10 fourth-age sows were used and housed in a farrowing room on the participating farmer's premises. Their general state of health was examined by a veterinarian. The piglets were suckled by the sow without external rearing and were given piglet starter feed from the 10th day of life. The piglets were weaned on the 28th day of life. In the rearing unit, two litters were housed together in one pen. At twelve weeks of age, the piglets were transferred to the fattening unit with the following mix: 30 (FI) received the planned vaccinations against pathogens, 30 (FNI) subsequently received the frequency-based drops. Vaccinated and unvaccinated animals were placed together. The piglets had free access to feed and water during the trial period [10-13].

On the fourth day of life, 30 (FI) of the piglets received a standardised intramuscular iron injection. The male piglets were castrated under general anaesthesia and received pain relief on the 14th day of life. The 30 piglets (FI) were vaccinated against Mycoplasma hyopneumoniae on the 21st day of life. The health status of the piglets and sows was monitored daily throughout the entire trial period.

Experimental Design and Sampling

A total of 60 clinically healthy piglets – equal numbers of male and female animals – with an average body weight of 1.50 ± 0.25 kg were selected and divided into two groups with equal numbers of male and female animals. Piglets in the FV group received a single intramuscular injection of vegetable oil-based vaccine at the recommended dose of 5.0 mg/kg on day 0 of their lives, within one hour of selection. Piglets in the untreated control group NV did not receive any injections [14-18].

Five days after birth, the following secretions were collected from all piglets: blood, urine, faeces, saliva, swabs from any abnormalities on the skin, and ear and eye swabs. The identified pathogens, which are found circulating in a pig breeding and fattening facility, were treated in the NV control group with the corresponding counterfrequencies over a period of 30 days. A minimum current of 0.0014 A was used, which corresponds to 75% of the usual current in relation to the alternating voltage, in order to neutralise the identified pathogens and pollutants with destructive interference. These secretion analyses were carried out every 34 days and evaluated using conventional laboratory techniques and frequency-based methods. Across all sampling times, 14 different strains were identified using conventional laboratory techniques, with different strains predominating as the pigs aged. On day 0, the predominant strains were Proteobacteria and Firmicutes in both sexes. The Enterobacteriaceae family dominated the microbiota composition on day 0, followed by Clostridia in both sexes. These predominant families were mainly represented by four very common OTUs, which accounted for 84% of all measurements, including the unclassified Enterobacteriaceae OTU1, Clostridium perfringens OTU2, unclassified Enterobacteriaceae OTU4 and unclassified Clostridia OTU5 on day 0 across all genders [18-20].
In addition to the pathogens already determined by conventional laboratory techniques, the frequency-based analysis revealed other pathogens and contaminants such as toxoplasmosis, Campylobacter pylori, Coli Bac., Aspergillus niger, Coxsacki B5, C2, B6, botulism, Staphylococcus aureus, salmonella,

cytomegalovirus, listeriosis, Tuberculinum bovinum, parotitis, Erysipelas suum, Chlamydia pneumonia, various Bacillus strains, as well as various metabolic toxins and, in some cases, environmental toxins such as glyphosate. In total, 94 pathogens and pollutants were identified as circulating in the barn between birth and slaughter. All of these pathogens and pollutants were identified in varying compositions in the animals and neutralised accordingly.

Results and Discussion

All animals remained healthy throughout the experiment and no pigs died or had to be removed from the experiment. Body weight changed gradually between the two experimental groups and between male and female pigs over time. On day 97, however, the male and female pigs in the NV group weighed more than the males and females in the VI group. On average, the animals in the NV group weighed approximately 5-7 kg more than the animals in the VI group. The significance of frequency analysis for the economy lies in particular in the prospect of a significant improvement in cost and resource efficiency. In agriculture, frequency analysis could reduce the use of pesticides by only diagnosing a problem when it is detected. The accurate identification of pests at an early stage makes it possible to avoid crop failures and reduce the use of chemicals and fertilisers. These differences between earlier analysis systems and current technological developments in the field of frequency analysis, particularly through the incorporation of innovations in sensor technology and data analysis, enable these methods to be applied even more precisely and quickly than before. With the increasing availability of IoT (Internet of Things) systems and big data analysis methods, frequency analyses can be performed online, avoiding errors and optimising processes more proactively. This approach can also give resource-poor regions an advantage in making their agricultural systems more resilient. However, there are still some hurdles to overcome at present. Integrating frequency analysis into existing production systems requires users to be highly innovative and undergo training, which increases implementation costs. Furthermore, interpreting frequency data and validating results is complicated, requiring further research and the establishment of a standard protocol. Figure 3 shows another connection between the problems we have based on the biological cycle. In this context, it is important to consider all these parameters as a whole. This makes the economic aspect significant not only for farmers, but also in the context of the economy as a whole. Good soil does a great job by giving plants everything they need to grow optimally. These then provide all the trace elements, micronutrients and vitamins to animals (as feed) and, via food, to humans. The overall calculation of a complete micronutrient cycle, which has optimally supplied all participants, and, in contrast, process errors in such a cycle, require an interdisciplinary understanding. However, such an overall calculation also reveals all the costs and deficits that occur within such a cycle. In order to be able to make such a calculation, an integrated and methodical framework must be developed and applied. This should combine various assessment methods in order to analyse closed cycles in agricultural and food systems in terms of their economic, environmental and cycle performance. Life Cycle Assessment (LCA) evaluates all ecological impacts, Environmental Life Cycle Costing (ELCC) evaluates the monetary value of the ecological consequences – the upstream and downstream costs – and the Material Circularity Indicator (MCI) evaluates the material recyclability. The overall picture is intended to represent sustainability and resource optimisation opportunities and enable a reduction in climate impact and costs. This creates added value, for example through usable by-products, but above all it reduces the use of primary materials and reduces waste. CINARDI et al also address these aspects in their peer-reviewed study from 2024 and emphasise the importance of viewing and calculating the overall processes in order to achieve efficiency, save resources and obtain economic benefits. They concluded that input costs were reduced by 20-45%, synthetic fertiliser use was reduced by up to 60% and soil fertility was increased. As already mentioned, soil fertility is the starting point for all further processes in a living organism. It was thus determined that a holistic assessment of circular agricultural systems, in particular biological processes and including economic indicators, represents a useful tool for 20 If organisms are optimally nourished, processes can run smoothly and the organisms' immune systems can defend themselves well against pathogens and pollutants, so that the end products – be they plants, animals or humans – have only a very low risk of disease. FELIX et al conducted studies on various farm animals and explicitly demonstrated that a comprehensive diet is a crucial aspect of maintaining health and that, in dairy cows for example, nutrients such as glucose, glutamine and ketones have a demonstrable influence on the function of immune cells. The type and quantity of non-esterified fatty acids (NEFAs) in the bloodstream can determine whether the immune response is strengthened or suppressed. This would lead to a general increase in productivity and a decrease in disease and mortality rates, as well as the costs associated with illness, healing and regeneration [20-23].

Table 1: Costs for healthy and sick pigs in fattening, breeding and when applying frequency analysis

Category	Fattening – Healthy in €	Fattening – Healthy in € with Freq	Fattening – Sick in	Fattening – Sick in £ with Freq	Breeding – Healthy in £	Breeding – Healthy in £ with Freq	Breeding – Sick in €	Breeding – Sick in £ with Freq
Veterinarian	10	7	40	12	15	12	65	22
Medication	3	2	30	10	5	2	40	10
Separation costs	2	2	15	2	3	3	25	3
Energy and Bedding	5	5	7	5	7	7	12	7
Total	20	16	92	29	30	24	142	42

Source: BLE – FEDERAL OFFICE FOR AGRICULTURE AND FOOD, 2024 AND OWN DATA FROM FIELD STUDIES FROM 2020 TO 2025 USING FREQUENCY ANALYSIS

Results

Based on the relationship between bacterial, viral and material diversity and body weight in pigs, the pathogens that were most significant for the body weight of pigs during the trial period were identified. In principle, the immune systems of animals that were not chemically vaccinated were more stable and resistant to external influences, which was reflected in greater agility and development. By relieving the immune system, it was better able to protect the organism against circulating pathogens and pollutants that hindered processes and had to expend little or no energy to maintain its defensive function. Although the pigs in the FI group were visually and clinically classified as healthy, the deficit was evident in the conversion of feed into body mass, which is ultimately relevant for the farmer. In this context, the advantages of this method in terms of product quality were not examined, but will be the subject of one of the next trials.

Discussion

Disruptions in the early development of the immune system can have lifelong consequences for the host, as they impair the development of the organism. In addition to other factors such as stress, feed and water quality, in connection with the host's metabolism, which probably influenced body weight on day 97 of life, the strong correlations between body weight and the pathogen/pollutant environment suggested that the relief of the immune system through the neutralisation of the identified pathogens and pollutants may have been a factor contributing to the higher body weight gain in pigs in the NV group compared to the FV group.

Apart from maturation-related changes, which led to a more diverse composition of the faecal microbiota from day 0 to day 28, reflecting the process of breastfeeding and the introduction of the first solid food, the species-appropriate supply of feed and functional water is crucial in promoting and building up the immune system. The feed determines which minerals, trace elements and vitamins are made available for organism-specific processes to ensure that these can run smoothly. The use of feed supplements to trigger process-promoting reactions should be taken into account. It also highlights the importance of the health and fitness of the mother sow in order to equip the immune system to be transferred in such a way that it benefits the piglet and can offer it direct support. In this context, there are plans to set up a study to investigate the effect of relieving the immune system of the mother sow with natural means on the quality of the piglets.

Conclusion

In summary, it is important to build up a strong immune system that is capable of protecting itself against pathogens and pollutants, regardless of how they affect the organism, and without the significant use of chemicals. It was found that although pigs treated with antibiotics were also considered clinically healthy, the goal of producing higher biomass could not be achieved. Proof of the corresponding product quality, especially with regard to amino acids, is still pending. This aspect is perhaps even more important, as animal products are later used in the human food chain and also have a function to fulfil in human processes. Sensory properties, nutritional properties, hygienic-toxic properties and processing technology properties play a major role here.

The test showed that frequency technology has several advantages in terms of identifying and diversifying pathogens and pollutants, and that it was a faster and less complicated analysis method to use, which can not only examine faeces but also all bodily secretions in a single step.

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